Foraging of Black and Forster's Terns

Introduction. Two species of terns breed commonly on Malheur National Wildlife Refuge. The Forster's tern, Sterna forsteri, nests colonially in the center of Malheur Lake and forages up the Blitzen and Silvies Rivers valleys. The Black Tern, Chlidonias niger, nests in smaller colonies in marshes throughout the refuge. This study attempts to compare their foraging behavior, prey selection, and foraging efficiency, and evaluates the possibility of competition for food.

Materials and Methods. This study was conducted during a two-week period fro June 21 to July 7, 1972, on the Malheur National Wildlife Refuges Most of the observations were taken along the Center Patrol Road six tenths of a mile east of the junction to the Malheur Environmental Field Station. A pool formed below (north of) a culvert which passed under the road, and large numbers of carp and small fish were concentrated there. Between June 20 and June 28 Forsters terns were observed foraging for fish there.. Data was collected June 21,22, 23 and 24. Around June 28, water levels were altered throughout the valley. The water level in the pool described dropped approximately fourteen inches because the valve in the culvert was partially closed. The surface of the pool was less disturbed by the inflowing water, and the fish were more visible. However at about this date the Forster's terns ceased foraging in the Blitzen valley. Black terns were observed foraging for these fish June 30, and July 1 and2, and data was recorded July 1. Data on the foraging of Forster's terns was also obtained on the west shore of Benson pond on the evening of June 24.

Black terns were observed foraging in most of the marshy areas of the refuge throughout the study period. Data was gathered June 23,

June 27 and July 1 on birds foraging over the marsh south [illegible] of the center patrol road and the road to the Malheur Environmental Field Station, and south of the culvert described above.

Observations were made with 8X40 binoculars, with a 20X Spotting scope, and with the naked eye. Times were measured with a stopwatch, and some frequency data was recorded with a digital counter. When a series of feeding attacks by one bird was recorded, timing started with thefirst observed attack, but the first attack was recorded only on alternate series. Wind velocity was estimated subjectively, but most data was collected under cinditions of little or no wind.

Forsters terns were considered to be hunting during the time spent with the bill pointing downward (after Salt and Willard, 1971).

At the culvert pool the outcome of a hunting episode for either species was considered a success if a fish was caught, a miss if an unsuccessful dive was made, and a failure if no attack was made. An attack was defined as any dive in which the bird entered the water or dropped too close to the surface to immediately resume fishing. This level was found to be approximately at six feet altitude. At Benson Pond the outcomes were considered to be miss, success, and out-of-view, where the bird moved out of effective observing distance.

For Black terns the attacks were considered to be any movements from the line of flight to the surface of the water, or any deviations from the line of flight accompanied by reaching, snapping, or other hawking behavior. Hunting time was considered to be any time spent in flight over the marsh from the initial attack observed until the bird passed out of view , returned to a nest, or flew to confront an intruder.

Results. The observed foraging behavior of Forster's tern consisted of diving into the water from hights of six to thirty feet, to depths approaching one body length. In the culvert pool, the birds hovered with rapidly beating wings, but at benson pond they cruised along the shoreline, hovering occasionally, but frecuently diving without hovering. At Benson pond one Forster's tern was observed hawking insects for a distance of approximately forty feet at an altitude of approximately sixty feet. It attacked two different insects before passing from view.

Black terns exhibit at least four separable foraging patterns, characterised by the prey attacked.

The first of these is fishing. Birds circled the culvert pool and made slanting dives to the water's surface. They did not hover like the Forster's , and did not plunge into the water, but sat on the surface and reached down with the bill, or hovered above the surface and reached with the bill. This method was also employed for hunting emergent dragonfly larvae. In light wind black terns hovered like Forster's but again did not plunge below the surface. At Knox Pond, small fish pass through the outlet culvert and some are injured or killed. The terns catch and carry off these fish, but do not attack the multitude of unharmed fish in the water.

The second foraging pattern, called Skimming, consists of low (usually below six feet) foraging flight over open water. Attacks were made at the surface several times in rapid succession. The major target organisms of this foraging pattern appear to be emergent and rrecently emerged aquatic insects.

Over more closed marshes, the terns forager at altitudes of ten to twenty feet, occasionally dropping to the surface of the water for small insect prey, but hawking extensively around and above the bullrushes.

Foraging of Black terns.

Foraging pattern	Fishing	Skimming	Low Hawking	Low Hawking	High Hawking
Time of obs.	2:00-3:15 [illegible]	10:15- 11:30	8:30-9:00 A.M.	7:45-8:30 P.M.	4:45-5:30 P.M.
Wind	0-5 MPH	0-5 MPH	0-5 MPH	0-5 MPH	5-15 MPH
Hunting time (sec)	413	809	246	1015	-
Failures	28	-	-	-	-
Misses	16	-	-	-	5
Successes	3	-	-	-	13
Attacks	19	272	22	241	18
Time/attack	22 sec.	3 sec.	11 sec.	4 sec.	-
Time/success	137 sec.	-	-	-	-
%of attack successful	16%	-	45+% **	-	75% ***
%of attacks on flying insects	0%	49%*		79% (123/160)	100%

* Range = 0-88 , Median = 50%

** Six nest to nest forays observed with 13 attacks, therefore minimum of six captures in 13 attacks

*** Range = 50%-100% , Median = 66%

Foraging of Forster's terns - Fishing.

Time	6:45-7:30 P.M.	5:00- 6:00 P.M. *	Combined	From Salt & Willard, 1965-68
wind	15+ MPH	0-10 MPH	-	varied
Hunt. Time (sec.	291	220	511	-
Failures	11	11	22	-
Misses	8	4	12	-
Successes	3	1	4	-
Attacks	11	5	16	153
Time/attack	26 sec.	44 sec.	32 sec.	32 sec. **
time/ success	97 sec.	220 sec.	128 sec.	101 sec. **
% of attacks successful	27.3	20%	25%	24%
% of attacks on fish	100%	100%	100%	100%

* Data from Benson Pond

** These figures do not check. If the birds make 1 dive per 32 sec. and have a success ratio of 24%, then it would have one success per 133 sec.

This is labeled low hawking

The fourth behavioral pattern is exclusively aerial Hawking. This was most often observed between four and seven P.M., frequently in the company of Franklin's Gulls and Common Nighthawks. The terns foraged from hights of fifteen to one hundred feet, and occasionaly to hights estimated in excess ofone thousand feet. They were observed catching small weakly flying insects and ignoring larger more strongly flying species.

Foraging success at the culvert Pool.

Species	Forster's Tern	Black tern
Time	6:45-7:30 P.M.	2:00-3:15 P.M.
Wind	15+ MPH	0-5 MPH
Hunting Time (sec)	291	413
failures	11	28
Misses	8	16
Successes	3	3
Attacks	11	19
Time/attack	26 sec.	22sec.
Time/successes	97 sec.	137 sec.
%Of attacks successful	27%	16%

Discussion. The data collected on Forster's tern is meager, but matches extremely well with that of Galt and Millard (1971). This would seem to justify use of the data for comparison with Black terns

The Forster's tern appears to be almost exclusively piscivorous. The terns travel considerable distances from the nesting colony to forage. They appear to be dependant upon a single food source, which is patchily distributed, so food may very well limit population size or growth during the breeding season.

The Black tern is less of a specialist.. It will fish when the fish are concentrated, and the water surface is smooth. Even so, it is significantly less successful. Otherwise, its food consists mainly of insects. If their are concentrations of flying insects it will hawk. This seems to be the most common late afternoon foraging pattern. In the morning activity is restricted to the water's surface and to the first

fifteen to twenty feet of air. Food does not seem to limit the Black tern population during the breeding season. They hunt whatever is most plentiful and easiest to catch. Many terns hunt close to the nesting colonies. The adult terns began molting while the young were still being fed. This also would tend to indicate that food is [illegible] plentiful and easily obtainable that foraging does not constitute a serious drain on energy supplies.

The relative time spent observing the various foraging patterns do not reflect the relative amounts of time spent by the birds in these pursuits. Fishing is the rarest foraging pattern observed, but no judgemen ment can be made about the relative frequencies of the other foraging patterns.

The data presented demonstrate that during the period studied ~~competition f~~ there is no serious competition for food between the two species. Black terns captured fish only under conditions of super-abundance, and Forster's terns normally ignore insects. Competition may be more likely between Forster's tern and other fish-eating species, such as the herons, egrets, cormorants, or grebes, or between Black terns and other hawking species such as nighthawks, Franklin's gulls, or blackbirds.

To compare foraging efficiency directly, it would be necessary to collect the food items eaten and determine relative nutrient values It would also be necessary to determine the relative frequencies of capture of the various prey species. However, the evidence presented above c concerning distance traveledto foraging areas, the molt of the adult Black terns, and the selectivity in capturing flying insects tends to indicate that Black terns might be foraging more efficiently.

Literature Cited.

Salt, George C. and Daniel E. Willard, "The Hunting Behavior and Success of Forster's Tern," Ecology Vol. 52, No. 6, Autumn 1971.

Wayne Hoffman